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14. ABSTRACT

The Helicopter Aircrew Integrated Life Support System (HAILSS) Program is a U.S. Navy led effort that began in April 1997 at the Naval Air Warfare Center Aircraft Division (NAWCAD) Patuxent River, MD. The main contractor is Gentex Corporation, Carbondale, PA. The HAILSS ensemble provides CB, anti-exposure and fire protection in single 2-layered impermeable garment, greatly reducing the layers of clothing currently required. Since no comparable system currently exists, it is difficult to compare protection ensembles. However, if you compare the worst case scenario, up to seven layers of clothing would be required to provide the same level of protection HAILSS offers in just two layers. A more probable comparison of likely worn layers would show a nearly 20% reduction in weight of the HAILSS ensemble versus currently worn systems.

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Helicopter Aircrew Integrated Life Support System
HAILSS
Integration

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There is no approved configuration to provide both chemical/biological (CB) agent and anti-exposure protection to US Navy helicopter aircrew due to the high thermal burden imposed by the impermeable anti-exposure coverall and the additional layers for CB protection. No cooling technology is currently available to alleviate this thermal burden imposed on the aircrew.

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The HAILSS ensemble (Figure 1) provides CB, anti-exposure and fire protection in single 2-layered impermeable garment, greatly reducing the layers of clothing currently required. Since no comparable system currently exists, it is difficult to compare protection ensembles. However, if you compare the worst case scenario, up to seven layers of clothing would be required to provide the same level of protection HAILSS offers in just two layers. A more probable comparison of likely worn layers would show a nearly 20% reduction in weight of the HAILSS ensemble versus currently worn systems.

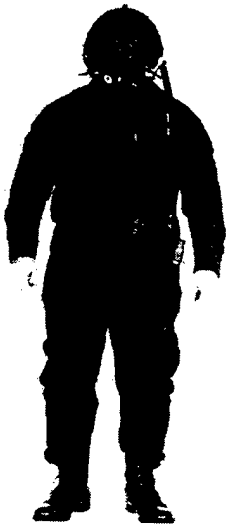

Figure 1. HAILSS Ensemble

The thermal burden associated with such encapsulating garments is alleviated by the Advanced Personal Air Conditioning System (APACS), which provides cool (or warm) airflow throughout the entire system including its integrated helmet.

The original design of the garment envisioned operating in central Europe, where the climatic conditions are relatively mild. Therefore, using ambient air to circulate in the garment and for breathing purposes was sufficient. A currently fielded SAB87 Austrian CB blower (Figure 2) was

Figure 2. SAB87 Blower

originally used for providing ambient air to the ensemble.

However, for US Navy helicopter operations, a much wider range of environmental conditions must be provided. Therefore, one of the primary goals of the HAILSS program was to provide a conditioned airflow to the garment. Physiologic testing comparing current Navy protective ensembles with HAILSS was conducted at NAWCAD Patuxent River, and concluded that conditioned air must be provided.

The APACS Program is a US Navy led science and technology (S&T) program that began in December 1998 at NAWCAD Patuxent River, MD. The main contractor is System Design and Engineering (SD&E), Friedrichshafen, Germany. One of the goals of the program is to develop a man-mounted portable air conditioning unit to provide cooled or warmed air to the aviator. The design parameters for the first phase of development was to cool the ambient air 10 °C (18 °F) at an airflow of 300 L/min for 3 hours.

The first stage of the program was to evaluate the dimensioning parameters of the various system modules, including the power supply, blower system and the conditioning unit. The contractor delivered two APACS Baseline Units (Figure 3) to the Navy in March 1999 for laboratory evaluation.

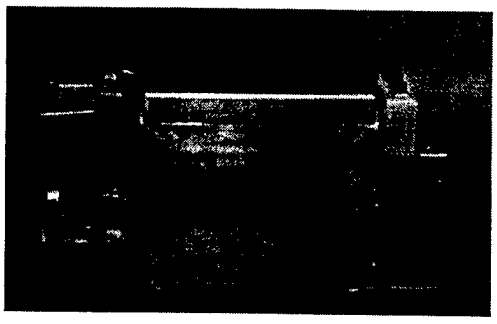

Figure 3. Baseline APACS System

Based on the results of APACS Baseline evaluations, the contractor redesigned the unit to meet specific Navy requirements. A man-mounted system independent of aircraft electrical power was one main design parameter. This allows the aircrew to perform pre- and post-flight tasks in full protection while still receiving conditioned airflow to the HAILSS garment.

The contractor delivered 2 Prototype APACS systems in November 1999. Improvements included a 44% reduction in weight while maintaining the overall cooling capacity. In addition, the Prototype system was mountable on the AIRSAVE survival vest.

Even with the tremendous reduction in overall size and weight, there were concerns regarding the ability of the aircrew to wear the system in an operational environment. There were additional concerns with integration of the system with other life support equipment and survival gear, including the flotation collar.
Therefore, a mockup (Figure 4) was designed and created to simulate a size of the APACS unit that could be integrated on the AIRSAVE while not

Figure 4. Mockup APACS Design

interfering with any other life support equipment. In addition, the mockup was designed to maintain the level of cooling attained in the Baseline and Prototype Systems.

To ensure this design would permit the aircrew to safely ingress, egress and operate the aircraft, ground testing was conducted using the AH-1W. Two test subjects wearing the mockup APACS configuration and the HAILSS ensemble were able to ingress and egress both the forward and aft cockpit (Figure 5). In addition, full flight control was possible while wearing the mockup.

Figure 5. Ground Test of Mockup APACS Configuration

Biography

Paul Dolinar is a Mechanical Engineer in the Crew Systems Department at the Naval Air Warfare Center Aircraft Division, Patuxent River Maryland. He received a BS in Mechanical Engineering from the University of Maryland in 1988. He has 11 years experience in various Navy RDT&E programs, and is currently assistant program manager for the Helicopter (HAILSS) and Smart (SAILSS) Aircrew Integrated Life Support Systems Programs.